

Attorney Docket No. 83134  
Customer No. 23523

DEVICE AND METHOD FOR PREVENTING  
SUPERHEATING OF LIQUIDS IN A MICROWAVE OVEN

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT ANTHONY A. RUFFA, citizen of the United States of America, employee of the United States Government and resident of Hope Valley, County of Washington, State of Rhode Island has invented certain new and useful improvements entitles as set forth above of which the following is a specification:

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3 DEVICE AND METHOD FOR PREVENTING  
4 SUPERHEATING OF LIQUIDS IN A MICROWAVE OVEN

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6 STATEMENT OF GOVERNMENT INTEREST

7 The invention described herein may be manufactured and used  
8 by or for the Government of the United States of America for  
9 governmental purposes without the payment of any royalties  
10 thereon or therefore.

11

12 BACKGROUND OF THE INVENTION

13 (1) Field Of The Invention

14 The present invention relates to microwave ovens, and in  
15 particular relates to a device and method of use to prevent  
16 superheating of liquid during heating within the microwave oven.

17 (2) Description of The Prior Art

18 Microwave ovens are commonly used to heat foods, beverages,  
19 and the like by people of all ages and intelligences. Unknown to  
20 the general public, heating liquids in a microwave oven can  
21 create a very dangerous condition. For example, if the water  
22 contained in a new or very smooth cup or bowl (e.g., one that  
23 does not have any scratches to initiate boiling) is brought to a

1 temperature of 100°C or greater in a microwave, it can be brought  
2 to a superheated (metastable) state.

3 Superheating takes place when a substance is heated above  
4 the temperature at which a change of state would ordinarily take  
5 place without such a change of state occurring, for example, the  
6 heating of a liquid above its boiling point without boiling  
7 taking place. When this superheated state is disturbed, a large  
8 amount of water can vaporize at once, causing the liquid to  
9 "explode" into the face of the person taking the cup or bowl out  
10 of the microwave resulting in first and second degree burns to  
11 the person.

12 Burn injuries from microwave use are not uncommon and are  
13 familiar to emergency room physicians. Presently, microwaves  
14 have no apparent indications to warn a person that a liquid is  
15 in a superheated condition. While precautions exist that can be  
16 taken to avoid creating a superheated condition, these  
17 precautions (and the condition itself) are not well known by the  
18 general public.

19 In view of the above, it is therefore desirable to have a  
20 device that reduces the likelihood of liquid superheating while  
21 being easy to use by the general public.

## SUMMARY OF THE INVENTION

1        Accordingly, it is a general purpose and primary object of  
2    the present invention to provide a device that reduces the  
3    likelihood of liquid superheating.

4        It is a further object of the present invention to provide  
5    a device adaptable for a microwave oven and easy to use by the  
6    general public.

7        A safety device according to the present invention includes  
8    a transducer disposed on a support surface. The support surface  
9    is adapted to support a container containing a liquid within a  
10   microwave oven. The transducer prevents the liquid from  
11   becoming superheated by vibrating the support surface such that  
12   the liquid within the container nucleates, thus allowing the  
13   liquid to boil.

14       In a preferred embodiment, the transducer is embedded  
15   within or secured to the support surface. Alternatively, the  
16   support surface may be either an integral element or removable  
17   element of the microwave oven. The transducer may be powered  
18   from a power source powering the microwave oven. The transducer  
19   may be powered by a pulsed impulse function, or driven in a  
20   sinusoidal mode and preferably operates at ultrasonic  
21   frequencies.

## BRIEF DESCRIPTION OF THE DRAWINGS

2 These and other features and advantages of the present  
3 invention will be better understood in view of the following  
4 description of the invention taken together with the drawing(s)  
5 wherein:

6 FIG. 1 is a schematic view of the safety device according  
7 to the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

10 Referring now to the drawing wherein like numerals refer to  
11 like elements, one sees that FIG. 1 depicts a safety device 10  
12 according to the present invention with the safety device  
13 designed to be used with a microwave oven 12. The safety device  
14 10 generally includes a transducer 14 positioned in a support  
15 surface 16 within the microwave oven 12.

16 In operation, the transducer 14 creates a vibrational force  
17 of a sufficient amplitude to cause standing waves in the surface  
18 18 of a container 20 containing a liquid 22, for example, but  
19 not limited to water. The waves generated by the transducer 14  
20 create nucleation sites for the liquid 22, thus allowing the  
21 liquid to boil. By boiling, a superheated state is avoided for  
22 the liquid 22.

23 The support surface 16 of a type known to those skilled in  
24 the art within the microwave oven 12 is sufficiently rigid to

1 allow vibrations generated by the transducer 14 to propagate  
2 throughout the entire support surface with a negligible decrease  
3 in amplitude. The standing waves generated by the transducer 14  
4 are of sufficient amplitude to dissipate or shock the liquid 22  
5 out of a superheated state. When breaking waves occur on the  
6 surface 18, this breaking wave action provides nucleation sites.

7 Standing waves of much less amplitude may be sufficient.  
8 High amplitude ultrasonic energy will produce cavitation even  
9 under normal conditions. When the liquid is in a metastable  
10 state to begin with, the amplitude needed to induce cavitations  
11 will be greatly reduced.

12 The transducer 14 may be any device capable of generating a  
13 vibrational force sufficient to cause nucleation of the liquid  
14 22 within the container 20. The transducer 14 may be powered  
15 using a power source (not shown) that powers the microwave oven  
16 12.

17 The transducer 14 may operate in several different modes,  
18 in that the transducer may create the vibrational force  
19 randomly, continuously, or periodically. For example, the  
20 transducer 14 may be powered by pulsed impulse functions with  
21 sufficient amplitude to shock the liquid 22. Alternatively, the  
22 transducer 14 may driven in a sinusoidal mode, but at ultrasonic  
23 frequencies, so that the standing waves would have very small  
24 wavelengths.

1        The transducer 14 may be activated manually, but is  
2        preferably automatically operated once the microwave oven 12 is  
3        activated. A timer (not shown) may also be used to activate the  
4        transducer 14 after a preset amount of time in the event that  
5        the container 20 is left within the microwave oven 12 after the  
6        microwave oven has finished heating the liquid 22.

7        In the preferred embodiment, shown in FIG. 1, the  
8        transducer 14 is embedded within or secured to the support  
9        surface 16. Alternatively, the support surface 16 may be an  
10       integral part or a removable element of the microwave oven 12.

11       Accordingly, the safety device 10 creates waves within the  
12       liquid 22. The waves create nucleation sites that allow the  
13       liquid 22 to safely boil and avoid becoming superheated. The  
14       device is easy to operate, thus making the microwave oven 12  
15       safer for general use.

16       In light of the above, it is therefore understood that  
17       within the scope of the appended claims, the invention may be  
18       practiced otherwise than as specifically described.